As to the forms of laccolites he does not believe in limiting the term to those intrusive bodies only that occupy a perfectly regular position with regard to stratification planes, but would apply it to any intrusive body where the expansion of the body has taken place from a plane even approximately parallel to the bedding. In horizontal strata the lifting of the load by the intrusive force may be taken as the prime essential. The deviations from the type forms from accidental causes are many. With regard to the origin of laccolites Cross cites a number of facts which demonstrate that the horizon occupied by intrusive magmas are not determined by relative densities of the intruding lavas and of the invaded strata, as suggested by Gilbert, and assuming eruptive energy such as exists in active volcanoes he concludes in the words of James D. Dana that "no other cause could be needed for a flow to the surface in case of an open channel, or for a flow to any level in the strata at which a fissure might terminate; and this is true whether the lava be light or heavy." J. P. I.

Petrology for Students. An introduction to the study of rocks under the miscroscope. By ALFRED HARKER. Published by Macmillan & Co., New York, 1895. Price $2.

As the author states in the preface this text-book is prepared especially for English students, nevertheless it will be found very useful for those beginning the study of petrography in this country, who wish a text-book written in English. No systematic account of the crystallographic and optical properties of minerals has been attempted, and for such information the student is referred to the translation of Professor Rosenbusch's volume on the rock-making minerals. But as an introduction to the study of the rocks themselves a number of useful observations of a general nature are presented upon the characters of minerals in thin section, and especially the latest methods of distinguishing the different varieties of feldspar. In treating so complex a subject as the optical properties of minerals in thin sections in such a condensed manner it is doubtful whether the author can meet the wants of a beginner. It serves, however, as a form of definition of the terms used throughout the book. It would seem that in neglecting the use of those methods of determination based on the optical phenomena observed with converging polarized light the author needlessly weakens the processes of petrographical diagnosis.

In his remarks upon the examination of rock sections the author

shows his appreciation of the broad field of the science, which, as he says, is not merely an attempt to discover the composition of a rock, but to unravel its history as well. His clear understanding of the subject is also shown in his discussion of the classification of rocks, especially those of igneous origin. In the present chaotic condition of the nomenclature of rocks it will be difficult for any one, who does not succeed in reforming the whole system, to classify rocks to his own complete satisfaction or to the satisfaction of anyone else. In his attempt at simplification Mr. Harker has shown his independence to a considerable extent, while following in the main the classification of igneous rock adopted by Rosenbusch, though under a different terminology. Thus massive igneous rocks are subdivided into *plutonic*, *intrusive* and *volcanic*, corresponding closely to *tiefengesteine*, *ganggesteine and vulkanischegesteine.* In many other ways also the author follows the methods and principles of Rosenbusch. Under each of the three great divisions above named the rocks are arranged according to their mineralogical or chemical composition beginning with the most acid. The names used for varieties of rocks within different families are generally those expressing the mineralogical characteristics of the particular variety rather than those of a geographical character, which may already be in common use. But in most cases both names are given. The most noticeable instance of this is in the treatment of the peridotites.

In substituting the term *intrusive* for that of *ganggesteine* and in maintaining an independent grouping for certain varieties of intrusive rocks the author has not improved on the presentation of the case as made by Rosenbusch, and his remarks in introduction of his *intrusive* division are in the nature of an apology. Nor does his use of the term, acid intrusives, in distinction to that of porphyries and porphyrites, appear to be fortunate. Diabases are classed as intrusives. Under *volcanic* rocks no distinction is made between older and younger lavas, which certainly seems to be the only proper method of treatment. In this respect the classification follows the English usage. The fragmental products of volcanic action are described in connection with sedimentary rocks.

The descriptions of the various rocks embrace a general definition in mineralogical and structural terms, followed by an account of the constituent minerals and of the microstructure. Illustrative examples are chosen as far as possible from occurrences in Great Britain. The many references to the writings of British geologists and numerous

others to the works of foreigners add greatly to the usefulness of the book for more advanced students.

The sedimentary rocks are divided into *arenaceous, argillaceous, calcareous* and *pyroclastic* kinds. Under the first division the general terms are defined, and the characters of the derived grains and of the authigenous constituents are discussed separately. In this way the general characteristics of all arenaceous rocks are given rather than the specific character of any one kind of rock.

In the chapter on argillaceous rocks the general definitions are first given, then the characters of the constituent minerals, followed by that of the structure. The description of illustrative occurrences serves to supply the need of some definite picture of different kinds of these rocks. The treatment of calcareous rocks is admirable for so condensed a statement. It deals first with the source and composition of these rocks, then the structure of organic fragments; followed by oolitic structure, the character of the matrix, and of deep-sea calcareous deposits. Finally metasomatic changes are described, and British examples cited. References to the literature of the subject are numerous and valuable. Pyroclastic rocks are briefly treated. Deposits due to chemical or to organic agencies are described in a few short paragraphs.

Under the head of metamorphism the author discusses the general principles of the subject, and then describes the changes produced by thermal metamorphism upon the different kinds of sedimentary rocks, and upon igneous rocks and the crystalline schists. This is followed by an account of the effects of dynamic metamorphism upon the minerals and structures of rocks. Very little space is devoted to the petrographical description of the various kinds of crystalline schists, which are grouped under the heads of crystalline schists, gneiss, granulites and eclogites. The basis of classification is structure.

The book shows careful preparation, and although the reviewer has taken exception to some features of it, he would recommend it to all those beginning the study of petrology. J. P. J.

Boletin de la Comision Geológica de México, No. 1; Fauna fossil de la Sierra de Catorce, San Luis Potosi. By ANTONIO DEL CASTILLO and JOSE G. AGUILERA; pp. ix + 53, with twenty-four plates, Mexico, 1895.

The authors state that they propose in this work to confirm the existence of the Jurassic system in Mexico, describing the most